



# A NOVEL APPROACH TOWARDS ROAD SAFETY BASED ON INVESTIGATIONAL SURVEY USING IMAGE PROCESSING AND USER INTERFACE SYSTEM

\*Dr. B. Paulchamy<sup>1</sup> | K. Archana<sup>2</sup> | A. Domnic Bruno<sup>2</sup> | I. Divya<sup>2</sup> | M. Gopala Krishnan<sup>2</sup>

<sup>1</sup> Head of Department,, Electronics and communication, Hindusthan Institute of Technology, Coimbatore, India - 641032.

(\*Corresponding Author)

<sup>2</sup> B.E, Electronics and communication, Hindusthan Institute of Technology, Coimbatore, India - 641032.

## ABSTRACT

This paper proposes a novel system which has the capacity to automatically detect the possible ways in which a vehicle can meet an accident and implement necessary actions to ensure the safety of people inside and outside the vehicle. This project proposes a novel approach towards road sign recognition, obstacle detection and speed control technique in order to avoid road accidents. The primary process of this project is to inform the driver of traffic signs and obstacles that may have been missed due to distraction or carelessness. A camera scans the roadside for signs. A real time image processing software MATLAB identifies interprets and displays them on a panel on the vehicle dashboard through Raspberry-pi.

**KEYWORDS:** Traffic Sign Recognition (TSR), Detection, Classification, MATLAB platform, Obstacle detector, Speed regulation technique, Raspberry-pi.

## INTRODUCTION

Vehicle has occupied its space among us in our day to day life. The accelerating modernization increased the usage of automobiles which has its own merits and demerits. Merits apart there are significant amount of accidents recorded resulting in human loss every year. It is necessary to ensure that adequate actions are taken in order to prevent such accidents. One of the major factors which contribute to road accidents is unawareness about the surrounding environment which can be known through traffic signs placed on adequate intervals. Drivers have to pay attention to various conditions, including vehicle speed and orientation, the distance between vehicles, passing cars, and dangerous or unusual events ahead. Applications have been developed focused on the traffic sign area such as alert system of the possible danger, navigation and driving safety. If driver assistance system can collect such information in prior, it will greatly reduce the burden of driving for drivers and make driving safer and easier. Traffic sign detection has a direct impact on the safety of driver, and damages can be easily produced due to their ignorance. Automatic systems developed to assist the driver based on detection and recognition of signs can consequently correct the most unsafe driving behavior.

Examples of such a system which automatically slows down the car if it is moving too close to the vehicle in front of it include adaptive cruise control, lane departure warning system, collision avoidance system, night vision, traffic sign recognition, and etc [1]. Automatic traffic sign detection and recognition, as an essential task of Advanced Driver Assistance Systems, has been of great interest in recent years.

They provide important information regarding to guiding, warning, or regulating the behaviors to drivers in order to make driving safer and easier [1]-[2]. The main purpose of driving assistance systems is to collect significant information for drivers in order to reduce their effort in safe driving. Driving information mentioned above could be detected by many kinds of devices, such as infrared rays, ultrasonic waves, microwaves, radar, and a computer vision system. These devices can be utilized to extract various kinds of data from the driving environments [3]. Road signs are designed to attract a driver's attention with particular colors and simple geometric shapes. However, the difficulty in recognizing road signs is largely due to the following reasons:

- (1) The colors of road signs, especially red, may fade after Long exposure to the sun.
- (2) Air pollution and weather conditions (e.g., rain, fog, shadows, and clouds) may decrease the visibility of road signs.
- (3) Outdoor lighting conditions varying from day to night may affect the colors of road signs.
- (4) Obstacles, such as vehicles, pedestrians, and signs, may partially occlude road signs.

Traffic sign detection has a direct impact on the safety of driver, and damages can be easily produced due to their ignorance. Automatic systems developed to assist the driver, based on detection and recognition of signs can the most unsafe driving behaviors [4]-[5].

In this present trend road signs are detected by image processing software MATLAB which performs detection, classification and recognition. This existing method involves Region of Interest (ROI) and pixel classification technique. This technology requires large amount of database. This system involves only road sign recognition which does not intimate the driver about the road sign detection.

## Disadvantages in existing method

1. No indicator
2. No speed control technique
3. No obstacle detection

So, we designed a system which intimates the driver about various traffic signs, obstacles kept along the road and regulate the speed at perfect interval even if the driver fails to recognize them.

## MATERIALS AND METHODS:

Road transport in India is very popular for various reasons, but the condition of Indian roads is very poor and deplorable. The rate at road-accidents and fatality in the country is very high. Pressure on roads has been on increase and the number of vehicles is increasing by leaps and bounds.

The accidents recorded in the recent years show in the fig.1 this shows the comparison of accident causes and its statistics. The reason for most of the accidents in the four wheelers is carelessness and over speed. Here this fig.1 shows the data which is get from the first information record from the police stations.

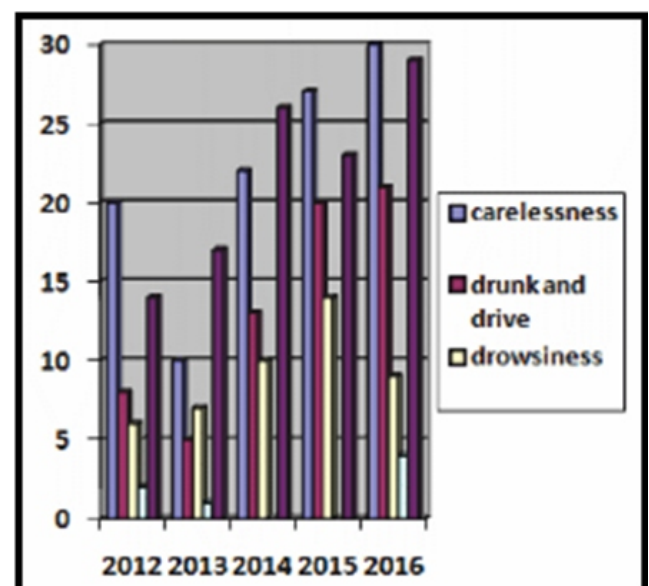


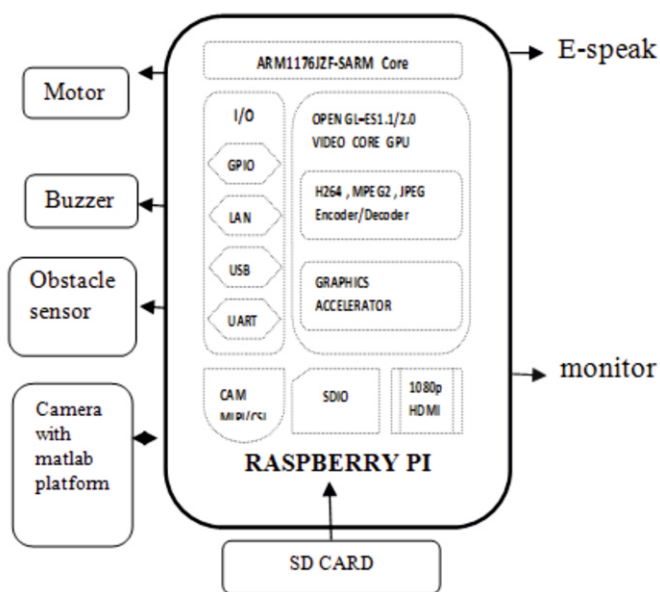
Figure1. Accident statistics in recent years

- The previous approach on automatic detection and recognition on road sign for driver assistance system proposed by Ahmed Hechri and Abdellatif Mitvaa based on YCBCR algorithm. The main drawback of this system is no speed control techniques and indicator were used and no image based signal detection [4].
- Real time detection and recognition of road traffic sign by Jack Greenhalgh and Majid Mirmehdi attempted to make a system capable of automatic recognition of traffic sign by using Vector machine classifier and trained histogram of oriented gradient feature. The serious disadvantages of this method are usage of large online database and no obstacle detection [3].
- A recent research on Road side detection and recognition for driver assistance system by Amoljayant Kale and R.C.Mahajan based on road sign recognition using MATLAB without indicator and speed control techniques and obstacle detection [2].

#### PROPOSED METHOD

This section describes the proposed system which detects recognize the road sign such as pedestrian crossing, school zone, speed breakers and indicates the driver through e-speak and monitor and controls the speed of vehicle by using Raspberry Pi.

#### BLOCK DIAGRAM



#### Raspberry-pi:

Raspberry-pi is the mini computer which has the Linux operating system and it supports python code language. It has four USB slots, HDMI and composite video output and a jack for audio.

In this block diagram the whole system is controlled by Arm11 processor and this processor is implemented on Raspberry Pi Board. So this board is connected with monitor, camera, SD card and IP connected through LAN. Those all components are connected by USB adaptors. Raspberry pi is the key element in processing module which keeps on monitoring road signs by interfacing USB camera in that applicable area.

#### Camera with MATLAB platform:

Here the detection and classification modules are performed by image processing software MATLAB which is used here for traffic sign recognition purpose. It uses large database to identify and classify the traffic sign.

#### Ultrasonic sensor:

Obstacles on roads are detected by sensor. And intimate the driver.

#### Motor:

Here motor is connected with Raspberry-pi. When interrupt occurs in Raspberry-pi speed of the motor will be reduced. There are many ways to control the speed but one of the easiest way to control the speed is pulse width modulation (PWM) technique.

#### E-speak and Monitor:

Finally detected output is indicated through E-speak (audio output) and monitor on Raspberry Pi. For certain signs such as speed break, school zone speed of the vehicle will be reduced with the help of Raspberry Pi.

#### Flow Chart

This section describes the flow of road sign detection and recognition for driver assistance system.

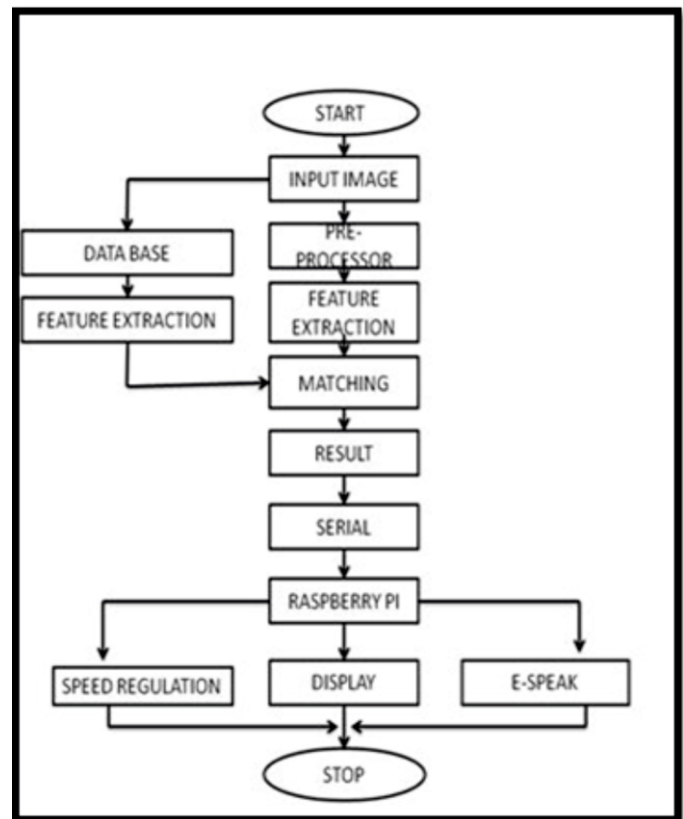


Figure 3. Flow chart

In first step the road sign image were taken in good quality web camera so that road signs can be taken during various weather conditions at different angles. When image is captured by web camera the image is given as input image to MATLAB platform which performs detection and recognition process.

Detection and recognition process involves following steps.

1. Pre-processing
2. Feature extraction
3. Matching

1. In pre-processing step an improvement of the image data that suppress unwanted distortions or enhances some image features improvement for further processing.

2. Feature Extraction means converting input image from pictorial to non-pictorial data representation. Here mathematical tool such as MEAN is required to find the non-pictorial data representation of an input image.

Generally input image is given to both image processor and database. Database contains two or more samples of road sign. Feature extraction process is done in database also.

3. In this matching process image taken by web camera and image from database after feature extraction is compared and recognize the sign.

After the recognition process done in MATLAB platform the result is given to Raspberry-pi through serial port. The result will be in the form of interrupt. When interrupt reaches Raspberry-pi the speed regulation and indication process takes place. Display and E-speak is used for indication purpose.

#### RESULTS AND DISCUSSION:

Here web camera captures the road sign and it is detected and recognized with the help of MATLAB platform. The matched traffic sign from the database is identified and indicated to users. Figure 4 and 5 shows camera with MATLAB platform. The output displays the result of traffic sign identified from the database.



Figure 4. Web camera

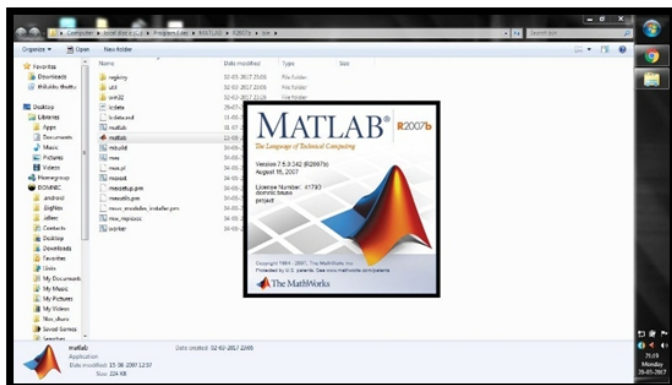


Figure 5. MATLAB platform

Obstacle detection sensor used in this system is much efficient than the previous system which detects the obstacles on the road and indicate the driver. Figure 6, show the obstacle sensor with user interface.

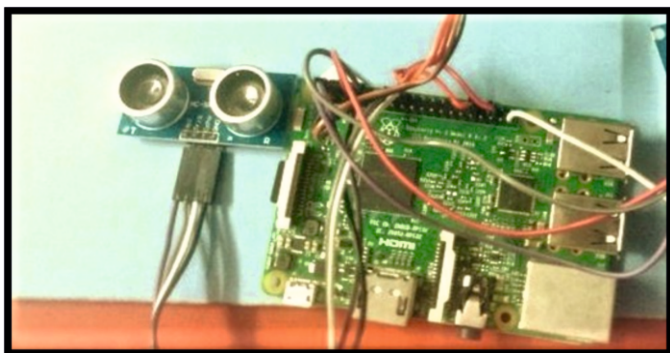


Figure 6. Ultra sonic sensor with raspberry-pi

When traffic signs or obstacle is detected the speed regulation technique is implemented which controls the speed of the vehicle that prevents from the accidents, due to over speed and carelessness. By implementing our proposed system in the real-time will reduce the accidents by 90%.

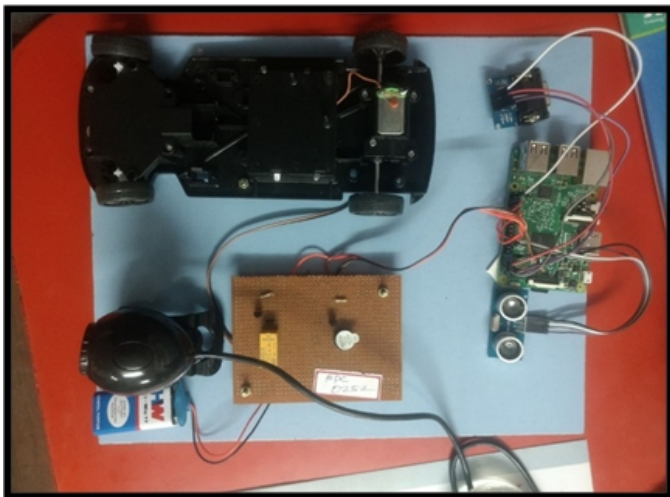


Figure 7. Snap shot of hardware

The fig.7 shows snap shot of entire hardware system. This hardware can handle the interrupts which comes from the MATLAB platform.

### CONCLUSIONS:

In this paper we present one of the accident prevention techniques in the real world. And our proposed system for road sign recognition is developed by image processing software MATLAB and tested with Raspberry Pi. This traffic sign recognition, obstacle detection and speed control technique is very helpful for safe travelling. In this project adaptive and accurate mechanisms have been applied to extract and recognize the content of each traffic sign. However, some improvements will be done in future. Hence the obtained output proves the efficiency of our approach.

### ACKNOWLEDGMENTS:

The authors would like to thank sub inspector of chettipalayam police station, Coimbatore district for providing opportunity and necessary accident survey details to support this paper work.

### REFERENCES

- [1] Loy G and Barnes N, "Fast shape-based road sign detection for a driver assistance system", IEEE/RSJ international conference on intelligent transportation systems, vol 1, pp 70-75 (2004).
- [2] AJ Kale and R.C.Mahajan "A Road sign detection and the recognition for driver assistance system" IEEE International conference (2015).
- [3] Jack Greenhalgh and Majid Mirmehdi "A real time detection and recognition of road traffic signs" IEEE conference (2012).
- [4] Ahmed Hechri and Abdellatif Mitabaa "Automatic detection and recognition of road sign for driver assistance system" IEEE conference (2012).
- [5] Karthiga.PL and Mansoor Roomi "Traffic sign recognition for an intelligent vehicle/driver assistant system using HOG (2016).
- [6] Md.Safaet Hossain and ZakirHyder "Traffic road sign detection and recognition for automotive vehicle" International journal of computer application (2015).
- [7] M.Sajjad Hossain, M.Mahmudul Hasan and M.Ameer Ali "Automatic detection and recognition of traffic signs" IEEE conference (2010).
- [8] Abdelhamid Mammeri and Azzedine Boukerche and Mohammed Almulla "Design of traffic sign detection, recognition and transmission system for smart vehicles" IEEE conference (2014).
- [9] Nagakishore Bhavanam "Automatic speed control and accident avoidance of vehicle using multiple sensor" ICIECE (2014).
- [10] A.deEscalera, LE Moreno, MASalichs and J.M. Armingol "Road traffic sign detection and classification" IEEE conference (2002).
- [11] AncaApatean and Alexandria Rogozan "Sensor for obstacle detection- A survey" IEEE conference (2014).
- [12] S.H. Hsu and C.L. Huang, "Road sign detection and recognition using matching pursuit methods" Image and Vision Computing (2001).
- [13] Yan Han, Kushal V irupakshappa, EsdrasVitor Silva Pinto and ErdalOrulku "Hardware/Software Co-design of a traffic sign recognition system using zynq FPGAs" (2015).
- [14] C.Y.Fang, C.S.Fuh, P.S.Yen, S.Cherngand S.W.Chen "An automatic road sign recognition system based on a computational model of human recognition processing" computer vision and image understanding (2004).
- [15] R.Malik, J.Khurshid and S.Ahmad, "Road sign detection and recognition using color segmentation, shape analysis and template matching," in proc.ICMLC (2007).
- [16] N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," in proc. CVPR (2005).
- [17] W. Ritter, F. Stein, R. Janssen, "Traffic sign recognition using color information", Mathematical and Computer Modelling, 1995
- [18] L.D. Lopez, O. Fuentes, "Color-based road sign detection and tracking", Proc. Image Analysis and Recognition (ICIAR) Montreal, CA, August 2007.
- [19] Y.R. Fatmehsan, A. Ghahari, R.A. Zoroofi, "Gabor wavelet for road sign detection and recognition using a hybrid classifier", International Conference on Multimedia Computing and Information Technology (MCIT), 2010.
- [20] N. Chourasia Jitendra, Bajaj Preeti, "Centroid Based Detection Algorithm for Hybrid Traffic Sign Recognition System", ICETET, pp. 96-100, 2010.
- [21] A.D.L. Escalera, J.M.A. Armingol, M.Mata, "Traffic sign recognition and analysis for intelligent vehicles", Image and Vision Computing, vol. 21, pp. 247-258, 2003.
- [22] N.Kehtamavaz, N.C. Griswold, D.S. Kang, "Stop-sign recognition based on colour-shape processing", Machine Vision and Applications, vol. 6, pp. 206-208, 1993.
- [23] G Loy, N Barnes, "Fast shape-based road sign detection for a driver assistance system", Proceedings of the IEEE/RSJ international conference on intelligent robots and systems, vol. 1, pp. 70-75, 2004.
- [24] RC Gonzalez, RE Woods, "Digital image processing" in, Prentice Hall, January 2002.
- [25] J Torresen, J Bakke, L Sekanina, "Efficient recognition of speed limit signs", Proceedings of the 7th international IEEE conference on intelligent transportation systems, pp. 652-656, October 2004.
- [26] S.H. Hsu, C.L. Huang, "Road sign detection and recognition using matching pursuit method", Image and Vision Computing, 2001.
- [27] K. Duan, S. Sathiyar, A. Poo, "Evaluation of simple performance measures for tuning the SVM hyperparameters", Neurocomputing, vol. 51, pp. 41-59, 2003.
- [28] E. Perez, B. Javidi, "Nonlinear distortion-tolerant filters for detection of road signs in



- background noise", IEEE Trans. Veh. Technol., vol. 51, no. 3, pp. 567-576, May 2002.
- [29] C. G. Keller, C. Sprunk, C. Bahlmann, J. Giebel, G. Barattoff, "Real-time recognition of U.S. speed signs", IEEE Intelligent Vehicles Symposium, pp. 518-523, 2008.
- [30] E. Coersmeier, S. Jaborek, P. Paul, M. Bucker, M. Hoffmann, L. Pustina, S. Schwarzer, F. Leder, P. Martini, "Multicore processing for object recognition in mobile devices", Embedded World Conference, 2008.
- [31] S. Tang and L.-L. Huang, "Traffic sign recognition using complementary features," in Pattern Recognition (ACPR), 2013 2nd IAPR Asian Conference on. IEEE, 2013, pp. 210-214.
- [32] N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," in Computer Vision and Pattern Recognition, 2005. CVPR 2005. IEEE Computer Society Conference on, vol. 1. IEEE, 2005, pp. 886-893.
- [33] T. Ojala, M. Pietikainen, and D. Harwood, "A comparative study of texture measures with classification based on featured distributions," Pattern recognition, vol. 29, no. 1, pp. 51-59, 1996.
- [34] J. Stallkamp, M. Schlipsing, J. Salmen, and C. Igel, "The german traffic sign recognition benchmark: a multi-class classification competition," in Neural Networks (IJCNN), The 2011 International Joint Conference on. IEEE, 2011, pp. 1453-1460.
- [35] D. Ciresan, U. Meier, J. Masci, and J. Schmidhuber, "A committee of neural networks for traffic sign classification," in Neural Networks (IJCNN), The 2011 International Joint Conference on. IEEE, 2011, pp. 1918-1921.